IAP20 Rec'd PCT/PTO 0 5 MAY 2006

A VIDEOCONFERENCE SYSTEM AND THE ADMINISTRATING METHOD THEREOF

Field of the Invention

[0001] The present invention relates to videoconference
technology, more particularly to a videoconference system and
a management method thereof.

Background of the Invention

[0002] In a videoconference, the participants can hear/see one
party, multiple parties, or all other participants by
encoding/decoding and transmission of video and audio data. At
present, videoconference systems mainly include a narrow-band
videoconference system that employs ITU-T H.320 Series standard
and a VoIP videoconference system that employs H.323 Series
standard. Referring to FIG.1, a videoconference system mainly
includes a Multipoint Control Unit (MCU) 1 and terminals 2. MCU
1 can control multiple terminals in the videoconference. Since
all video and audio data has to be processed by MCU 1 (sometimes
encoding/decoding is also required). The access capability and
data processing capability of MCU 1 limit the maximum number
of videoconferences supported as well as the maximum number of
terminals 2. Furthermore, compared with terminals 2, MCU 1 is
more expensive, and thereby is a precious resource in
videoconference systems. Therefore, a conference management
system is required to perform conference dispatching and
allocation of MCU resource.

[0003] In general, traditional videoconference systems are

oriented to enterprises and private network markets, and the conference management system mainly pertains to either of the following two solutions:

[0004]   The first solution: The MCU manufacturer provides a local conference management system 41 or a conference management system embedded in MCU 1 for managing terminals 2, as shown in FIG.2. In this solution, a dedicated administrator has to be assigned for each MCU 1; the subscribers request for conference dispatching to the administrator via network 3 by telephone, fax, or email; the administrator performs dispatching for the corresponding conference in the videoconference system in accordance with the requests from subscribers. If a cascade conference has to be dispatched, the administrator has to determine which terminals 2 are under MCU 1 manually and create cascaded conference sites manually.

[0005]   The disadvantage of the solution includes:

[0006]   With this solution, all conference management work has to be done manually, which is inefficient, and when there are many MCUs 1, the management is more difficult. Therefore, the solution is usually applied to small-scale corporate videoconference systems, which can not meet the demand of videoconference operators.

[0007]   The second solution: if there are multiple MCUs 1, usually the conference is managed in a centralized manner, as shown in FIG.3. That is to say, a dedicated conference management system 43 is used to manage the multiple MCUs 1. Such a videoconference system usually provides a subscription interface, through which the subscribers can request for conference dispatching; the

conference management system 43 will accomplish the allocation of MCU 1 resource and the cascading automatically.

[0008]   Though conference management is easier with this solution, conference can be held only via the MCUs in the system. Usually, video operating systems are usually constructed by region. Even if a single operator can construct a national conference management system, videoconference service across operators or countries can still not be managed uniformly. These videoconference systems isolated to each other tend to result in lack of MCU resource as well as severe waste of network bandwidth, because videoconference service consumes bandwidth severely. It is supposed that a subscriber in Shenzhen wants to have a videoconference at 384kbps with 10 subscribers in Beijing, and if an MCU in Shenzhen has to be used for the videoconference, the maximum bandwidth consumption between Shenzhen and Beijing can be up to 10x384kbps; however, if an MCU in Beijing is to be used for the videoconference, the maximum bandwidth consumption between Shenzhen and Beijing will be 384kbps.

[0009]   Through a cascaded videoconference using multiple videoconference systems can be held by manual dispatching or by utilizing MCUs in other systems, the entire process has to be intervened manually because participation of administrators in the systems is required. Therefore, it is evident that the demand of the public videoconference operation can not be met.

Summary of the Invention

[0010]   An advantage of the present invention is to provide a videoconference system and a management method thereof, so as to implement dispatching and control of conference management systems across conferences.

[0011]   A videoconference system according to the embodiment of the present invention includes:

terminals;

multipoint control units, as the superior level for the terminals, for controlling the corresponding terminals to participate in the videoconference;

conference management systems, as the superior level for the multipoint control units, for managing resource allocation of the corresponding subordinate multipoint control units to meet subscribers' demand, and performing conference dispatching and control for the local conference site; and

conference coordination systems, as the superior level for the conference management systems, for coordinating corresponding subordinate conference management systems and the neighboring conference coordination systems to perform dispatching and control for the entire conference at a dispatching request.

[0012]   Each conference coordination system includes:

a system management module, for accomplishing system configuration and operating management of the conference coordination system;

a conference dispatching module, for processing conference dispatching requests from the subordinate conference

management systems or from the neighboring conference coordination systems;

a conference control module, for forwarding conference control data; and

5   a multipoint communication module, for communicating with the subordinate conference management systems and the neighboring conference coordination systems.

[0013]   The multipoint communication data in the multipoint communication module includes source node ID, channel ID, list

10   of destination nodes, upper layer application data and application data segment mark, and the conference coordination systems implement routing strategy by using the channel ID and list of destination nodes in the multipoint communication data.

[0014]   The system configuration of the system management module

15   includes:

the terminals being numbered uniformly;

the conference management system being configured with number segments to determine corresponding terminals; and

the conference coordination systems being configured with

20   number segments managed by the corresponding conference management systems and number segments managed by the neighboring conference coordination systems, so as to determine a plurality of conference management systems involved in the conference in accordance with the system configuration, split

25   the conference into sub-conferences, and distribute the sub-conferences to each corresponding subordinate conference management system during a videoconference.

During a videoconference, the conference coordination systems determine a master conference management system and a slave conference management system dynamically in accordance with the system configuration and dispatching strategy.

[0015]   During a videoconference, one of the subordinate multipoint control units managed by the master conference management system serves as the master multipoint control unit, the other multipoint control units in the master conference management system and the multipoint control units in the slave conference management system serve as slave multipoint control units, and the master conference management system accomplishes cascading among the master and slave multipoint control units.

[0016]   The dispatching strategy of the conference coordination systems is to determine the master conference management system in accordance with the number of terminals managed by the conference management systems and to determine whether to merge the sub-conferences into the master conference management system in accordance with the number of sub-conferences.

[0017]   The videoconference system management method according to an embodiment of this invention includes the steps of:

[0018]   1) a subscriber requesting for conference dispatching from the home conference management system;

2) the home conference management system managing the corresponding local conference sites directly at the dispatching request, and transferring the dispatching across conference management systems to the corresponding conference coordination system; and

3) the conference coordination system dispatching the corresponding master and slave conference management systems at the dispatching request.

[0019]   Step 3) further includes the steps of:

31) the conference coordination system determining each terminal's home conference management system;

32) the conference coordination system splitting the videoconference into sub-conferences and distributing the sub-conferences to each corresponding conference management system;

33) the conference coordination system determining a master conference management system and a plurality of slave conference management systems.

[0020]   Before step 1), the videoconference system management method further includes the steps of:

numbering the terminals in the videoconference uniformly;

configuring the conference management systems with number segments to determine corresponding terminals;

configuring the conference coordination systems with number segments managed by the corresponding conference managements system and number segments managed by the neighboring conference coordination systems, so that the conference coordination system can perform dispatching in accordance with the corresponding managed number segments.

[0021]   The videoconference system management method further includes the following step between step 2) and step 3):

the conference coordination system dispatching the corresponding neighboring conference coordination systems.

[0022] The videoconference system management method further includes the following steps after step 3):

4) the master and slave conference management systems feeding the dispatching result back to the corresponding conference coordination system;

5) the conference coordination system feeding the final dispatching result back to the home conference management system that sent the dispatching request.

[0023] Compared with the prior art, the embodiments of this invention have the following advantages:

[0024] with a distributed and cascaded videoconference management mechanism to implement dispatching across the entire network and the entire videoconference, and thus it can optimize the operator's network configuration, improve equipment utilization, and reduce investment cost;

[0025] it can implement automatic cascading, hold any large-scale videoconference efficiently and quickly, without any need to designate a dedicated person to perform conference dispatching and control, and thereby can easily implement interconnection across operators and across countries to meet the demand for public videoconference operation;

[0026] through conference dispatching by number segments and thresholds of terminals, it can make utilization of MCU and network resources more rational.

Brief Description of the Drawings

[0027]   FIG.1 is the schematic diagram of a videoconference system;

[0028]   FIG.2 is the diagram of an embodiment of a videoconference system in the prior art;

[0029]   FIG.3 is the diagram of another embodiment of the videoconference system in the prior art;

[0030]   FIG.4 is the diagram of a videoconference system according to a first embodiment of the present invention;

[0031]   FIG.5 is the diagram of an embodiment of the solution as shown in Fig.4;

[0032]   FIG.6 is the block diagram of the conference coordination system in the videoconference system according to the first embodiment of the present invention;

[0033]   FIG.7 is the diagram of the communication model of conference coordination system in the videoconference system according to the first embodiment of the present invention;

[0034]   FIG.8 is the diagram of a videoconference system according to a second embodiment of the present invention;

[0035]   FIG.9 is the flow diagram of the method for managing the videoconference system according to the second embodiment of the present invention.

Detailed Description of the Embodiments

[0036]   In the videoconference system according to an embodiment

of the present invention, a superior conference coordination system is added based on the existing centralized conference management system, so that the isolated videoconference systems are integrated into a videoconference network, in order to take

5   full advantage of the scale merit of the network to meet the demand of the videoconference operation.

[0037]   The videoconference system according to an embodiment of the present invention is in a tree-type distributed structure and includes: multipoint control units, terminals, conference

10   management systems, and conference coordination systems; in which:

[0038]   The terminals refer to network devices that can perform bidirectional and real time communication with the multipoint control units or other terminals; the communication includes

15   control, instructions, voice, moving images, and/or data;

[0039]   The Multipoint Control Units (MCUs) serve as the superior level for the terminals and controls the corresponding subordinate terminals to participate in the videoconference;

[0040]   The conference management systems serve as the superior

20   level for the MCUs and are used to manage resource allocation of the corresponding subordinate MCUs to meet subscribers' demand as well as perform conference dispatching and control for the local conference sites (i.e., terminals participating in the conference) during the conference;

25 [0041]   The conference coordination systems serve as the superior level for the conference management systems, and are used to coordinate   each   corresponding   subordinate   conference

management system and neighboring conference coordination systems to perform dispatching and control for the entire conference at the dispatching request.

[0042]   The conference coordination systems are superior to the conference management systems; each conference coordination system can manage multiple conference management systems; each conference management system communicates with only the corresponding conference coordination system. The conference coordination systems are peer to peer and can request for conference dispatching to each other.

[0043]   Hereinafter, the dispatching request refers that a subscriber requests for conference dispatching (including start time, duration of the conference and terminals involved in the conference) from the home conference management system, i.e., the conference management system where the account number of the conference caller is.

[0044]   The conference coordination systems perform control of the conference with conference control data which includes conference state data and conference control commands. Wherein, the conference state data refers to the data reported by each conference management system to the corresponding superior conference coordination system and forwarded by the conference coordination system to other conference management systems, including start/end of conference, entering/leaving of conference site, or change of chairman token; the conference control commands include prolongation/ending of conference, calling/hanging up/adding/deleting/broadcasting/viewing of conference site, setting mode of continuous presence, etc. The

conference coordination systems forward conference state data and conference control commands to other conference management systems participating in the videoconference, and record the original bill data for data verification in the settlement between the conference management systems.

[0045]   In the embodiment as shown in Fig.4, the conference coordination systems are disposed separately. In this case, the videoconference system includes:

[0046]   twenty-two terminals 2;

[0047]   six MCUs 1, which serve as the superior level for terminals 2, and each MCU 1 manages two terminals 2;

[0048]   conference management systems 44, 45 and 46 serving as the superior level for MCUs 1, each of the conference management systems manages two MCUs 1;

[0049]   conference coordination systems 51 and 52 serving as the superior level for the conference management systems 44, 45, and 46; wherein, the conference coordination system 51 is the superior level for the conference management systems 44 and 45, while the conference coordination system 52 is the superior level for the conference management system 46; the conference coordination systems 51 and 52 are neighboring to each other, and can dispatch each other.

[0050]   In order to enable the conference coordination systems to coordinate each corresponding subordinate conference management system and the neighboring conference coordination systems to perform dispatching and control of the entire conference in accordance with dispatching requests, conference

control data and dispatching strategy, the entire videoconference system is configured uniformly. The conference coordination systems need to determine each conference management system corresponding to each terminal. In this embodiment, the terminals are configured similar to telephone numbers, as shown in Fig.5:

[0051] The terminals in the videoconference system are configured with numbers uniformly (e.g., in E.164 code). For example, the twelve terminals are configured with numbers as follows: 07551001, 07551002, 0201001, 0201002, 0101001, 0101002, 0102003, 0102004, 01231001, 01231002, 01231003, and 01231004;

[0052] The conference management systems determine the corresponding subordinate terminals in accordance with the configured number segments. In this embodiment, a number segment is used to serve as the common prefix of the numbers of terminals corresponding to the conference management systems; for example, the conference management systems with the configured number segments 0755 and 020 can manage terminals with number prefixes 0755 and 020, while the conference management systems with the configured number segment 010 can manage terminals with number prefix 010; similarly, the conference management systems with the configured number segment 0123 can manage terminals with number prefix 0123;

[0053] The conference coordination systems are configured with number segments managed by the corresponding conference management systems and number segments managed by the neighboring conference coordination systems. For example, the conference coordination systems with the configured number segments 0086755,

008620 and 008610 can manage the conference management systems with the configured number segments 0755, 020 and 010 and thereby determine terminals corresponding to the conference management systems, i.e., determine the conference management systems corresponding to the terminals that are numbered uniformly; similarly, the conference coordination system with the configured number segment 001123 can manage the conference management systems with the configured number segment 0123, and thereby determine the terminals corresponding to the conference management systems. The conference coordination systems that can dispatch each other are configured as "neighboring" conference coordination systems.

[0054] During a videoconference, a conference coordination system determines multiple conference management systems involved in the conference in accordance with the system configuration (terminal number, number segment configuration, etc., wherein each terminal participating in the conference is also referred to as a conference site), and splits the conference into sub-conferences and distributes them to the corresponding subordinate conference management systems (the videoconference held by each conference management system is referred to as a sub-conference of the videoconference), and determines a master conference management system and slave conference management systems dynamically in accordance with dispatching strategy. Hereinafter the conference coordination systems are described in detail with reference to the dispatching process:

[0055] The conference coordination systems determine the conference management systems or the conference coordination

systems corresponding to the terminals in accordance with the terminal numbers, so as to determine the conference management systems involved in the conference; the conference coordination systems split the conference into multiple sub-conferences and then distribute them to other conference management systems;

[0056] The conference coordination systems determine the master conference management system in accordance with the corresponding strategy; for example, the conference coordination systems can determine the master conference management system (i.e., the conference management system where the master MCU is; hereinafter the master conference management system will be described in detail) in accordance with the number of terminals;

[0057] The conference coordination systems determine whether to merge sub-conferences in accordance with appropriate dispatching strategy, so as to reduce unnecessary cascades; for example, a threshold may be set, so that the terminals involved in the sub-conferences can be merged into the master conference management system directly when the number of sub-conference sites is lower than the threshold. Here, the dispatching strategy of the conference coordination systems is to determine the master conference management system in accordance with the number of terminals managed by the conference management systems and to determine whether to merge the sub-conferences into the master conference management system in accordance with the number of sub-conferences.

[0058] In addition, the master conference management system refers to the conference management system where the master MCU is when

a cascade across conference management systems is required in a videoconference; the slave conference management systems refer to conference management systems that do not contain the master MCU when cascades across conference management systems are required in a videoconference. In the subordinate MCUs managed by the master conference management system, only one MCU serves as the master MCU, while the other MCUs managed by the master conference management system and the MCUs managed by the slave conference management systems serve as slave MCUs, and the master conference management system accomplishes cascading among the master and slave MCUs. In addition, "cascade" here refers to the conference mode of the master and slave MCUs cascading with each other in a videoconference, i.e., a videoconference is held based on multiple MCUs, wherein there is only one master MCU, and the other MCUs are slave MCUs; the master and slave MCUs are linked together directly through communication link connections.

[0059] During conference dispatching, when a conference management system receives conference dispatching request data, it treats the local conference site independently first (the number segment managed by each conference management system can be configured and distributed to each corresponding conference management system by a conference coordination system); if all of the conference sites are local ones, the conference management system will dispatch locally and doesn't need to interact with the conference coordination systems;

[0060] If the conference involves any conference site that does not correspond to the conference management system, the

conference management system will submit the dispatching request to a conference coordination system for processing. The conference coordination system will send a sub-conference dispatching request to each corresponding conference

5 management system or the conference coordination system (more details in the dispatching process of the conference coordination system); after all sub-conferences are dispatched successfully, the master conference management system will accomplish the cascading among the master and slave MCUs.

10 [0061] During a conference across multiple conference management systems, since each conference management system can only manage and control the state of the sub-conference held in itself, the conference coordination system has to route and transfer conference state data and control commands to control the entire

15 conference and manage allocation of MCU resource, so as to ensure the resource required by the conference meet the subscribers' requirements. A conference across systems can be implemented by the conference management systems communicating with the conference coordination systems. When the conference management

20 system does not communicate with the conference coordination system, it operates as a centralized conference management system.

[0062] In particular, each conference coordination system includes: (See FIG.6)

[0063] a system management module 61, for accomplishing system
25 configuration (e.g., numbering, number segment configuration) and operating management of the conference coordination system;

[0064] a conference dispatching module 62, for processing conference dispatching requests from the subordinate

conference management systems or the neighboring conference coordination systems;

[0065]   a conference control module 63, for forwarding conference control data; and

5 [0066]   a multipoint communication module 64, for communicating with the subordinate conference management systems and the neighboring conference coordination systems.

[0067]   As shown in FIG.7, the communication models between a conference coordination systems and the subordinate conference

10   management systems as well as between the conference coordination systems are based on the International Organization for Standardization (ISO) 7-layer model for communication; wherein, the International Telecommunications Union transport service ITU-T X.224 is used below transport

15   layer 71, the upper layer for the transport layer 71 is a multipoint communication module 64, the upper layer for the multipoint communication module 64 is a conference management application layer 72 (e.g., a conference dispatching module 62, a conference control module 63).

20 [0068]   The multipoint communication data in the multipoint communication module 64 employs (but not limited to) the following format to carry upper layer data:

{

    source node ID,

25   channel ID,

    list of destination nodes;

    application data segment mark,

upper layer application data,

    ...

    }

[0069]   Each conference coordination system implements routing
strategy by utilizing the channel ID and list of destination
nodes in the multipoint communication data, so as to improve
communication efficiency and facilitate modular design of upper
layer applications. For example, channels with IDs of 1-1,000
can be used to transfer conference dispatching request data;
channels with ID>1,000 can be used to control the conference.
The conference dispatching request data can be sent directly
to the conference dispatching module 62 for processing. For
conference control data (including state data and control
commands), the routing strategy can be configured further; for
example, when the conference coordination systems do not need
the conference control function, it is unnecessary to send the
conference control data to the conference control module 63 in
each conference coordination system. When the conference
coordination systems need only billing function, the conference
control module 63 can send only start/end of conference,
entering/leaving of conference site etc., and billing-relevant
information to the conference coordination systems; when a
conference management system doesn't need to control the
conference, it is unnecessary to send the conference control
data to the conference management system. That is to say, the
conference coordination systems perform conference control as
required, besides conference dispatching across systems.

[0070]   The conference coordination systems may be separated from

the conference management systems (see FIG.4 and FIG.5) or embedded in the corresponding conference management systems (see FIG.8).

[0071]   Accordingly, the method for managing the videoconference system comprises the steps of:

[0072]   1) a subscriber requesting for conference dispatching from the home conference management system;

[0073]   2) the home conference management system processing the corresponding local conference sites directly at the dispatching request, and transferring the dispatching across conference management systems to the corresponding conference coordination system;

[0074]   3) the conference coordination system dispatching the corresponding master and slave conference management systems at a dispatching request (during the conference dispatching process, the conference coordination system performing control of the conference in accordance with the conference control data and performing dispatching with reference to the dispatching strategy) by the steps of:

[0075]   the conference coordination system determining each terminal's conference management system;

[0076]   the conference coordination system splitting the videoconference into sub-conferences and distributing them to the corresponding conference management systems;

[0077]   the conference coordination system determining the master conference management system and the slave conference management systems;

[0078]   4) the master and slave conference management systems feeding the dispatching result back to the corresponding conference coordination system;

[0079]   5) the conference coordination system feeding the final dispatching result back to the home conference management system that sent the dispatching request.

[0080]   If the dispatching request indicates to dispatch a neighboring conference coordination system, dispatching a corresponding neighboring conference coordination system in accordance with the corresponding number segment managed by it; the corresponding conference coordination system executing steps 3) – 5).

[0081]   Before the dispatching process, the videoconference system management method includes the steps of:

[0082]   1) numbering terminals in the videoconference system uniformly;

[0083]   2) the conference management systems determining corresponding terminals in accordance with the configured number segments;

[0084]   3) configuring the conference coordination systems with number segments managed by the corresponding conference management systems and number segments managed by the neighboring conference coordination systems.

[0085]   The conference coordination system applies conference control data and dispatching strategy during the videoconference.

[0086]   FIG.9 shows an embodiment of the method for managing the videoconference system. When a cascaded conference site is added across conference management systems, the method includes the following steps:

5 [0087]   (1) a subscriber requesting for conference dispatching to the home conference management system;

[0088]   (2) determining whether the conference dispatching request is a request across conference management systems or a local request;

10 [0089]   (3) the home conference management system processing the request, i.e., if the request is a local request, processing the corresponding local conference site; otherwise, transferring the dispatching across conference management systems to the corresponding conference coordination system;

15 [0090]   (4) the conference coordination system dispatching the corresponding master and slave conference management systems by the managed corresponding number segments in accordance with the dispatching request, conference control data, and dispatching strategy;

20 [0091]   (5) the master and slave conference management systems feeding the dispatching result back to the conference coordination system; wherein

[0092]   first, the corresponding conference coordination system dispatching the master conference management system;

25 [0093]   the master conference management system feeding the dispatching result back to the conference coordination system;

[0094]   the conference coordination system dispatching the slave conference management systems in accordance with the dispatching result;

[0095]   the slave conference management systems feeding the dispatching result back to the conference coordination system;

[0096]   the conference coordination system dispatching the master conference management system to add a cascaded conference site;

[0097]   the master conference management system feeding the cascading result back to the conference coordination system;

[0098]   (6) the conference coordination system feeding the final dispatching result back to the home conference management system that sent the dispatching request.

[0099]   If the dispatching request indicates to dispatch a neighboring conference coordination system, dispatching a corresponding neighboring conference coordination system is dispatched in accordance with the corresponding number segment managed by it; the corresponding conference coordination system executing corresponding dispatching process.

[0100]   During a videoconference, the process of adding a terminal or prolonging the videoconference is similar to the process of adding a cascaded conference site across conference management systems, which will not be described in further detail.

[0101]   In conclusion, compared with the prior art, the videoconference system and the management method thereof according to the embodiments of the present invention employ a cascaded and distributed conference management to implement

dispatching for the entire conference across the entire network, and thereby optimize the operator's network configuration, improve equipment utilization, and reduce investment cost; in addition, the videoconference system and the management method thereof can implement automatic cascading and hold any large-scale videoconference efficiently and quickly, without any need to designate a dedicated person to perform conference dispatching and control, thereby can easily implement networking across operators and across countries to meet the demand for public videoconference operation; through conference dispatching by number segments and thresholds of terminals, the videoconference system and the management method thereof can make utilization of MCU and network resources more logical.